Western Tubenose Goby (*Proterorhinus semilunaris*)
Ecological Risk Screening Summary

U.S. Fish and Wildlife Service, February 2011
Revised, June 2015

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1 Native Range, and Status in the United States

Native Range

From Fuller et al. (2015):

"Slightly brackish to freshwater. Eurasia, primarily in rivers and estuaries of the Black Sea basin; also in rivers of northern Aegean (Miller 1986, Freyhof and Naseka 2007; Neilson and Stepien 2009)."

Status in the United States

From Fuller et al. (2015):

"The species was introduced into the St. Clair River, Michigan. It was taken in several 1990 collection samples from the cove next to the Detroit Edison Company's Belle River Power Plant and near the intake structures (Jude et al. 1992; Jude 1993; Jude, personal communication; G. Smith, personal communication). As of 1994, it also had been found at the north end of Lake St. Clair at Anchor Bay (Cavender, personal communication). In July 1997, a single tubenose goby was captured in Lake Erie at Port Glasgow, Canada (ROM 70904) (A. Dextrase, personal

communication). Since then, additional specimens have been found in the area (Kingsville Marsh) and the species is believed to be established on the northwestern shore of Lake Erie. Tubenose gobies have been collected in the waters of western Lake Erie around Catawba, Kelly's, and the Bass Islands, Ohio (Kocovsky et al. 2011), and in eastern Lake Erie in a small embayment (Marina Lake) adjacent to Presque Isle Bay, Erie, Pennsylvania (Grant et al. 2012). In 2001, a specimen was found in Duluth Harbor of western Lake Superior on the Minnesota-Wisconsin border (Vanderploeg et al. 2002). This species is also reported in Lake Huron (Cudmore-Vokey and Crossman 2000). Collected in Swan Creek, Monroe County in 2001 (Bowen, personal communication)."

"This species is believed to be established but rare in the St. Clair River, and in Lake St. Clair, Michigan (Jude 1993; Cavender, personal communication). Eggs attached to vegetation brought up during a trawl in 1994 were bought into a laboratory and hatched (Cavender, personal communication). This species is not spreading rapidly (Vanderploeg et al. 2002), but has undergone some recent expansion (Kocovsky et al. 2011)."

Means of Introductions in the United States

From Fuller et al. (2015):

"Introduced via ballast water."

Remarks

From Fuller et al. (2015):

"May be able to occupy all shallow waters of all five Great Lakes (U.S. EPA 2008) It is predicted by the GARP model to become established in Lake Erie and the shorelines areas of the other Great Lakes. Predictions could not be made for most of the rest of the region. Their distribution around the inshore areas of the Black and Caspian Seas indicates their potential for widespread occupation of inshore habitats where cover, especially plants, occurs in the lower Great Lakes (Jude et al 1992). Recently, tubenose gobies have expanded into the western and eastern basins of Lake Erie (Kocovsky et al. 2011; Grant et al. 2012)."

"Although *P. semilunaris* is widely dispersed among drainages within the Black Sea basin, it is threatened in certain locale. The tubenose goby is considered endangered in Greece in the Ayannis spring near the town of Seres due to pollution and human-induced habitat change (Economidis 1995). In the Greek State, the tubenose goby is protected by law No. 67/1981 (Economidis 1995). This goby may live as long as five years (Jude 1993)."

2 Biology and Ecology

Taxonomic Hierarchy and Taxonomic Standing

From CABI (2015):

"Kingdom: Metazoa
Phylum: Chordata

Subphylum: Vertebrata
Class: Actinopterygii
Order: Perciformes
Suborder: Gobioidei
Family: Gobiidae
Genus: Proterorhinus
Species: *Proterorhinus semilunaris*"

From Fuller et al. (2015):

"All tubenose gobies were previously included in a single species, *P. marmoratus*. Recently, *P. marmoratus* was restricted to marine/brackish populations in the Black Sea, and several names were resurrected/created for freshwater populations of tubenose gobies in different regions: *P. nasalis* and *P. semipellucidus* for populations inhabiting the Caspian Sea and Volga River basins (Freyhof and Naseka 2007; Neilson and Stepien 2009); *P. tataricus* endemic to several rivers on the Crimean Peninsula, Ukraine (Freyhof and Naseka 2007); and *P. semilunaris* for tubenose gobies in rivers and estuaries in the Black, Azov, and Aegean Sea basins (Freyhof and Naseka 2007; Neilson and Stepien 2009). *Proterorhinus semilunaris* is the only species of tubenose goby that has been introduced to North America (Stepien and Tumeo 2006; Neilson and Stepien 2009), and has also been introduced into several areas of central and western Europe (e.g., Manné and Poulet 2008; Cammaerts et al. 2011)."

Size, Weight, and Age Range

From Eakins (2015):

"Adult Length (cm): 4.5-7.7 TL
Adult Weight (kg): 0.001-0.006
Age at Maturity (yrs): 1-2
Maximum Length (cm): 9.0 SL
Maximum Weight (kg): no data
Lifespan (yrs): 3-4"

Environment

From Froese and Pauly (2015):

"Freshwater; brackish; benthopelagic."

Climate/Range

From Froese and Pauly (2015):

"Temperate"

Distribution Outside the United States

Native
From Freyhof and Kottelat (2008):

"Austria; Bosnia and Herzegovina; Bulgaria; Croatia; Greece; Hungary; Moldova; Netherlands; Romania; Serbia (Serbia); Slovakia; Turkey; Ukraine"

Introduced

From Freyhof and Kottelat (2008):

"In Danube, historically present up to about Vienna, invasive since 1970s, now reaching upstream to southern Germany. Recorded in 1999 from Rhine where it arrived from Danube through a canal and spread as far as the Netherlands (2002)."

Means of Introduction Outside the United States

From Freyhof and Kottelat (2008):

"It is increasing its range in the Danube and Rhine, reportedly facilitated by canalization of main river and reservoirs or slow-flowing waters created by hydroelectric plants."

Short Description

From Froese and Pauly (2015):

"This species (along with the round goby *Neogobius melanostomus*) can be distinguised from all other fishes in the Great Lakes by the presence of fused pelvic fins. Tubenose goby can be distinguished from the round goby by its long anterior nostrils and lack of black spot on posterior base of dorsal fin (Miller 1986; Jude 1993)."

Biology

From Froese and Pauly (2015):

"Inhabits a variety of slow-flowing or still waters from estuarine to small, slow flowing premontane streams; usually in dense vegetation or coarse rocks, and often very abundant in backwaters and lakes, breeds in reservoirs and channels. Preys on benthic invertebrates. Spawns for the first time at 1-2 years, usually for 1-2 seasons only, in April to August. Females may spawn more than once during the season and males guard the eggs that are deposited in cavities. Larvae and juveniles are benthic [Kottelat and Freyhof 2007]"

From Fuller et al. (2015):

"The tubenose goby is a benthic omnivores, consuming a wide variety of benthic invertebrates (chironomids, crustaceans, copepods, dipterans, ephemeropterans, ostracods, and trichopterans) and occasionaly larval fishes (French and Jude 2001; Adamek et al. 2007)."

"Generally inhabits shallow (less than 5 m depth), slow-moving, nearshore environments. Prefers areas with abundant aquatic macrophytes, but can also be found in sandy areas (Jude and Deboe 1996)."

Human uses
None reported.

Diseases
From Huyse et al. (2015):

"We morphologically and genetically document the co-introduction of the Ponto-Caspian *Gyrodactylus proterorhini* Ergens, 1967, originally described on tubenose goby in southern Slovakia. Because of their direct life cycle and extraordinary reproductive capacities, gyrodactylid monogenean parasites can readily invade new areas together with the host. Moreover, *G. proterorhini* has a wide host range and might therefore represent a threat to other gobiid fishes."

Threat to humans
From Froese and Pauly (2015):

"Harmless"

3 Impacts of Introductions
From Fuller et al. (2015):

"The tubenose goby does not feed on zebra mussels, as do round gobies (Vanderploeg et al. 2002). However, it has been shown to have a significant overlap in diet preference with rainbow darters (*Etheostoma caeruleum*) and northern madtoms (*Noturus stigmosus*) and may compete with these native fish for food (French and Jude 2001)."

From Vanderploeg et al. (2002):

"It is too small to efficiently feed on zebra mussels (French and Jude 2001). Ecological impacts, therefore, are expected to be minimal."

From Van Kessel et al. (2011):

"Various habitat choice experiments were conducted between two common native benthic fish species (*Cottus perifretum* and *Barbatula barbatula*) and four invasive non-native gobiid species (*Proterorhinus semilunaris*, *Neogobius melanostomus*, *N. kessleri* and *N. fluviatilis*). The first series of single specimen experiments determined the habitat choice of each individual fish species. In a second series of competition experiments, shifts in habitat choice in comparison with the previously observed habitat choice, were determined when a native benthic fish species co-occurred with non-native gobiid species. Native *C. perifretum* displayed a significant shift in habitat choice in co-occurrence with the gobiids *N. kessleri* or *P. semilunaris*. *C. perifretum* was outcompeted and moved from the available shelter place to less preferred habitat types. During the competition experiments no change in habitat choice of *B. barbatula* was shown. Our study therefore suggests that competition for shelter is likely to occur in rivers invaded by *N. kessleri* and *P. semilunaris* at sites where shelter is limiting"

From Vašek et al. (2014):

"One of the potential impacts of invasive gobies on native fish fauna is predation on eggs and fry. Therefore, the diet composition of two invading gobiid species, the tubenose goby *Proterorhinus semilunaris* and round goby *Neogobius melanostomus*, was examined in the Dyje river system (Danube basin, Central Europe) during the 2011 reproductive season to ascertain the extent of gobiid predation on heterospecific and conspecific eggs and juveniles. Consumption of fish eggs and juveniles by invading gobies was very low. The diets of both species consisted largely of benthic macroinvertebrates, and particularly insect larvae. These results indicate that invading gobies in the Dyje river system are likely to impact native fish fauna more through competitive effects than through direct predation on eggs and juveniles."

4 Global Distribution

Figure 1. Global distribution of *P. semilunaris*. Map from GBIF (2013).

5 Distribution within the United States

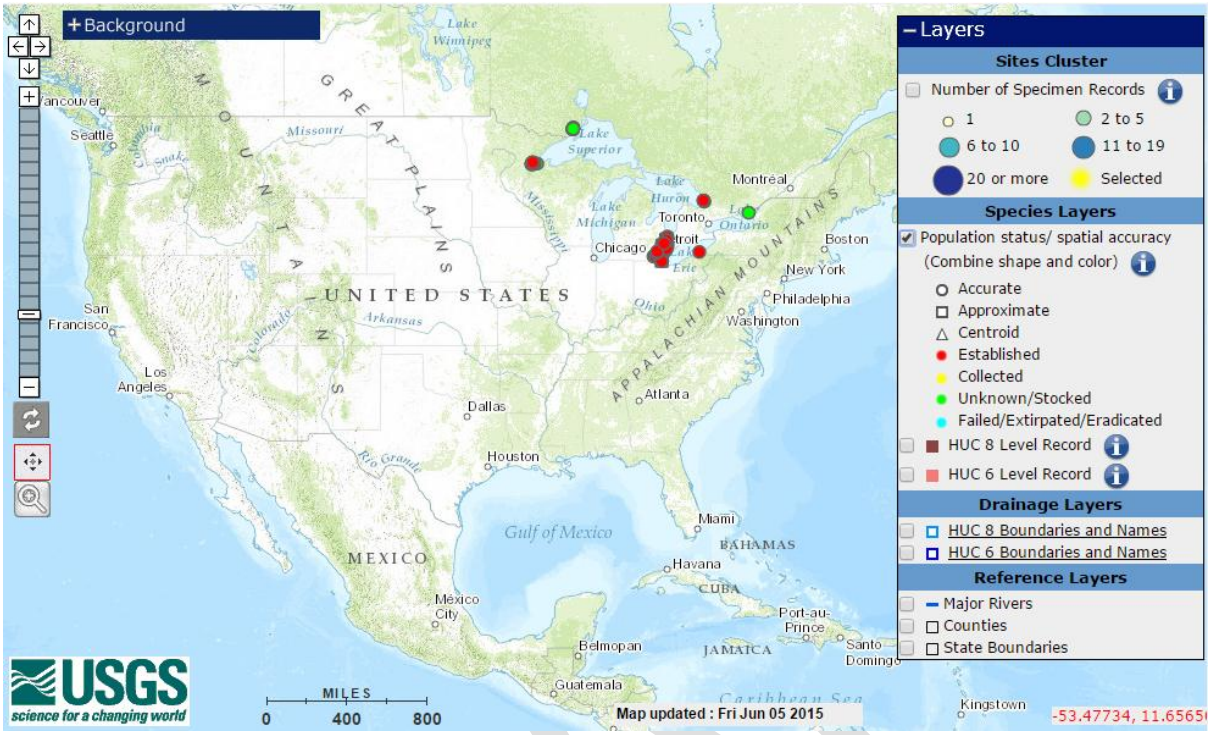

Figure 2. Distribution of *P. semilunaris* in the US. Map from Fuller et al. (2015).

6 Climate Match

Summary of Climate Matching Analysis

The climate match (Sanders et al. 2014; 16 climate variables; Euclidean Distance) was high throughout the entire Great Lakes basin and much of the Northeast and Mid-Atlantic regions. Climate matching was also high in parts of the West. The climate match was low in the South. Climate 6 score indicated that the US has a high climate match. The range for a high climate match is 0.103 and greater, climate match of *P. semilunaris* is 0.432.

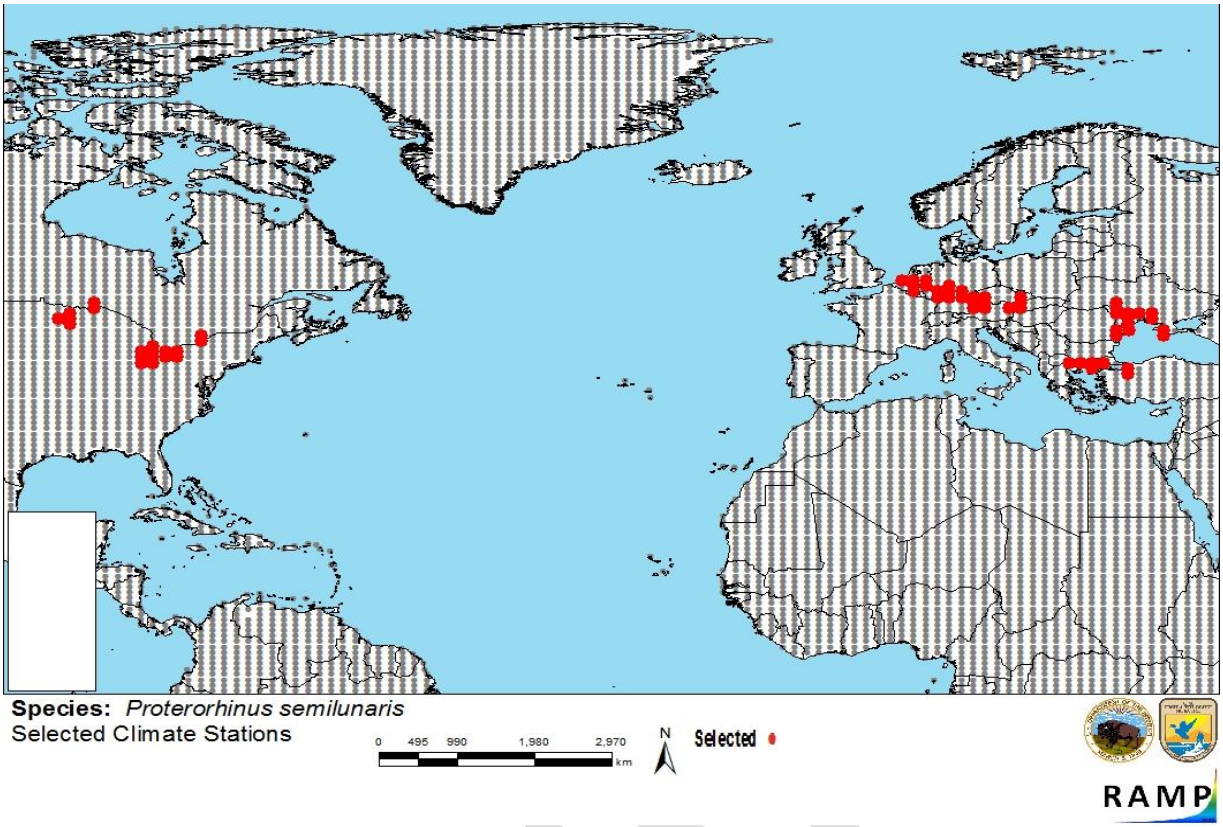

Figure 3. RAMP (Sanders et al. 2014) source map showing weather stations selected as source locations (red) and non-source locations (gray) for *P. semilunaris* climate matching. Source locations from GBIF (2013).

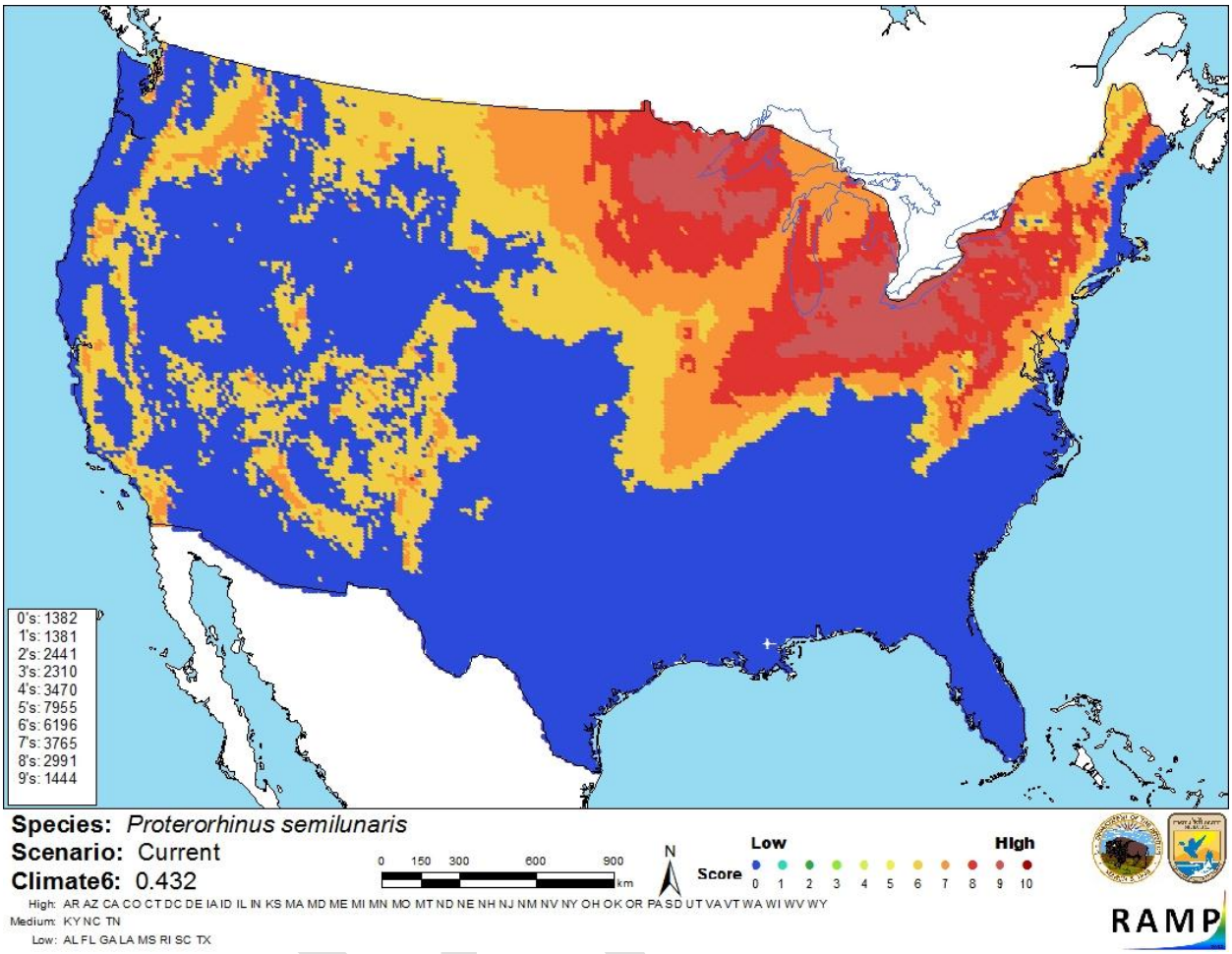

Figure 4. Map of RAMP (Sanders et al. 2014) climate matches for *P. semilunaris* in the continental United States based on source locations reported by GBIF (2013). 0= Lowest match, 10=Highest match.

7 Certainty of Assessment

Detailed information is lacking on the biology and impacts of *P. semilunaris*. It is expanding outside its native range, but no major ecological impacts have been documented in the places to which the species has spread. The certainty of this assessment is low.

7 Risk Assessment

Summary of Risk to the Continental United States

P. semilunaris has expanded its range in recent decades, becoming established in the Great Lakes and in new locations in Europe. There is some potential for competition with native species, however, ecological impacts are not likely to be as great as those caused by other gobiids. Most impacts are predicted to be the result of competition for resources with native fish species. Climate match with the contiguous US is high, especially within the Great Lakes basin. The lack of information on impacts makes the overall risk for this species uncertain.

Assessment Elements

- **History of Invasiveness (Sec. 3):** Uncertain
- **Climate Match (Sec. 6):** High
- **Certainty of Assessment (Sec. 7):** Low
- **Overall Risk Assessment Category: Uncertain**

9 References

Note: The following references were accessed for this ERSS. References cited within quoted text but not accessed are included below in Section 10.

CABI. 2015. *Proterorhinus semilunaris* (tubenose goby). Invasive Species Compendium. CAB International, Wallingford, UK. Available: http://www.cabi.org/isc/datasheet/116553. (June 2015).

Eakins, R. J. 2015. Freshwater tubenose goby. Ontario Freshwater Fishes Life History Database. Version 4.59. Available: http://www.ontariofishes.ca. (June 2015).

Freyhof, J., and M. Kottelat. 2008. *Proterorhinus semilunaris*. The IUCN Red List of Threatened Species. Version 2015.1. Available: http://www.iucnredlist.org/details/135487/0. (June 2015).

Froese, R., and D. Pauly. editors. 2015. *Proterorhinus semilunaris* (Heckel, 1837) Western tubenose goby. FishBase. Available; http://www.fishbase.org/summary/Proterorhinus-semilunaris.html. (June 2015).

Fuller, P., L. Nico, E. Maynard, M. Neilson, J. Larson, T.H. Makled, and A. Fusaro. 2015. *Proterorhinus semilunaris*. USGS Nonindigenous Aquatic Species Database, Gainesville, Florida. Available: http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=714. (June 2015).

Global Biodiversity Information Facility (GBIF). 2013. GBIF backbone taxonomy: *Proterorhinus semilunaris* (Heckel, 1837). Global Biodiversity Information Facility, Copenhagen. Available: http://www.gbif.org/species/2379245. (June 2015).

Huyse, T., M. P. M. Vanhove, M. Mombaerts, F. A. M. Volckaert, and H. Verreycken. 2015. Parasite introduction with an invasive goby in Belgium: double trouble? Parisitology Research. DOI 10.1007/s00436-015-4544-6.

Sanders, S., C. Castiglione, and M. Hoff. 2014. Risk Assessment mapping Program: RAMP. US Fish and Wildlife Service.

Van Kessel, N., M. Dorenbosch, M. R. M. De Boer, R. S. E. W. Leuven, and G. Van der Velde. 2011. Competition for shelter between four invasive gobiids and two native benthic fish species. Current Zoology 57(6):844-851.

Vanderploeg, H. A., T. F. Nalepa, D. J. Jude, E. L. Mills, K. T. Holeck, J. R. Liebig, I. A. Grigorovich, and H. Ojaveer. 2002. Dispersal and emerging ecological impacts of Ponto-Caspian species in the Laurentian Great Lakes. Canadian Journal of Fisheries and Aquatic Sciences 59:1209–1228.

Vašek, M., L. Všetičková, K. Roche, and P. Jurajda. 2014. Diet of two invading gobiid species (*Proterorhinus semilunaris* and *Neogobius melanostomus*) during the breeding and hatching season: no field evidence of extensive predation on fish eggs and fry. Limnologica 46:31–36.

10 References Quoted But Not Accessed

Note: The following references are cited within quoted text within this ERSS, but were not accessed for its preparation. They are included here to provide the reader with more information.

Adamek, Z., J. Andreji, and J. M. Gallardo. 2007. Food habits of four bottom-dwelling gobiid species at the confluence of the Danube and Hron rivers (South Slovakia). International Review of Hydrobiology 92:554-563.

Cammaerts, R., F. Spikmans, N. van Kessel, H. Verreycken, F. Chérot, T. Demol, and S. Richez. 2012. Colonization of the Border Meuse area (The Netherlands and Belgium) by the non-native western tubenose goby *Proterorhinus semilunaris* (Heckel, 1837) (Teleostei, Gobiidae). Aquatic Invasions 7:251-258.

Cudmore-Vokey, B., and E. J. Crossman. 2000. Checklists of the fish fauna of the Laurentian Great Lakes and their connecting channels. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2500.

Economidis, P. S. 1995. Endangered freshwater fishes of Greece. Biological Conservation 72(2):201-211.

French, J. R. P., III, and D. J. Jude. 2001. Diets and diet overlap of nonindigenous gobies and small benthic native fishes co-inhabiting the St. Clair River, Michigan. Journal of Great Lakes Research 27(3):300-311.

Freyhof, J., and A. M. Naseka. 2007. *Proterorhinus tataricus*, a new tubenose goby from Crimea, Ukraine (Teleostei: Gobiidae). Ichthyological Exploration of Freshwaters 18(4):325-334.

Grant, K. A., M. J. Shadle, and G. Andraso. 2012. First report of tubenose goby (*Proterorhinus semilunaris*) in the eastern basin of Lake Erie. Journal of Great Lakes Research 38:821-824.

Jude, D. J. 1993. The alien goby in the Great Lakes Basin. Great Lakes Information Network (Online).

Jude, D. J., and S. F. Deboe. 1996. Possible impact of gobies and other introduced species on habitat restoration efforts. Canadian Journal of Fisheries and Aquatic Sciences 53(S1):136-141.

Jude, D. J., R. H. Reider, and G. R. Smith. 1992. Establishment of Gobiidae in the Great Lakes basin. Canadian Journal of Fisheries and Aquatic Sciences 49:416–421.

Kocovsky, P. M., J. A. Tallman, D. J. Jude, D. M. Murphy, J. E. Brown, and C.A. Stepien. 2011. Expansion of tubenose gobies *Proterorhinus semilunaris* into western Lake Erie and potential effects on native species. Biological Invasions 13:2775-2784.

Kottelat, M., and J. Freyhof. 2007. Handbook of European freshwater fishes. Publications Kottelat, Cornol and Freyhof, Berlin.

Manné, S., and N. Poulet. 2008. First record of the western tubenose goby *Proterorhinus semilunaris* (Heckel, 1837) in France. Knowledge and Management of Aquatic Ecosystems 389:1-5.

Miller, P. J. 1986. Gobiidae. Pages 1019-1085 *in* P. J. P. Whitehead, M.-L. Bauchot, J.-C. Hureau, J. Nielsen, and E. Tortonese, editors. Fishes of the north-eastern Atlantic and the Mediterranean, volume III. United Nations Educational, Scientific and Cultural Organization, Paris.

Neilson, M. E., and C. A. Stepien. 2009. Evolution and phylogeography of the tubenose goby genus *Proterorhinus* (Gobiidae: Teleostei): evidence for new cryptic species. Biological Journal of the Linnean Society 96:664-684.

Stepien, C. A., and M. A. Tumeo. 2006. Invasion genetics of Ponto-Caspian gobies in the Great Lakes: a 'cryptic' species, absence of founder effects, and comparative risk analysis. Biological Invasions 8:61-78.

U.S. Environmental Protection Agency (U.S. EPA). 2008. Predicting future introductions of nonindigenous species to the Great Lakes. National Center for Environmental Assessment, Washington, D.C. EPA/600/R-08/066F. Available from the National Technical Information Service, Springfield, Virginia, and http://www.epa.gov/ncea.